

## ABSTRACT

A new synchronous Partial Response Maximum Likelihood (PRML) servo is provided for a high track-per-inch disk-drive system. To increase the data capacity in hard disk drives (HDD), one can shorten the servo format and/or increase the track density. The new servo system has circuits that allow a high-performance and accurate system for positioning the read-write heads. The major circuits include burst demodulation, Viterbi detection, timing synchronization, and spin-up search. A highly linear discrete-fourier-transform (DFT) burst-demodulation circuit can demodulate high-density and low-signal-to-noise-ratio (SNR) position bursts. The Viterbi detection circuit includes a sync-mark detector and a Viterbi detector that are matched to at least two sets of Gray code ( e.g., 1/4 rate and 4/12 rate) and pruned accordingly. The timing synchronization circuit includes phase restart and interpolating timing recovery (ITR) circuits to implement a fully digital timing recovery. The spin-up search circuit may include a robust multistage search circuit that detects a preamble and/or a DC field to search for an initial servo sector with a low error rate during spin up. In one example, the servo system samples each dibit 4 times throughout the entire servo sector uses PR4 equalization. The relatively low number of samples required for the system allows the servo format density to be near the channel bandwidth while increasing the SNR performance.